

Name:

Date:

# The Plasma Membrane

## Part 1: What controls the movement of materials into and out of the cell?

1. To be alive, most cells must maintain a relatively constant internal environment. To do this, they must be able to control the movement of materials into and out of the cell

What characteristics of the cell membrane determine what gets into the cell and what doesn't? What determines the permeability of the cell membrane? Answer the following questions to explore these issues.

<b>a. If a cell membrane were composed of just a phospholipid bilayer, what properties would it have?</b>	<b>b. What different roles and functions do membrane proteins serve?</b>	<b>c. Why are some cells more permeable to some substances (sodium ions, for example) than others?</b>

Using your understanding of the answers in a-c, answer the following question:

d. What characteristics of the cell membrane determine what gets into the cell and what doesn't? In other words, what determines the permeability of a cell or organelle membrane?

2. You design an experiment to test the effects that various compounds have on the osmotic potential of a model cell. You know that substances dissolved in aqueous or gaseous solutions tend to diffuse from regions of higher concentration to regions of lower concentration. You fill each of three (20 ml) dialysis bags half full with one of these substances:

- 5% by weight of glucose in distilled water
- 5% by weight of egg albumin (a protein) in distilled water
- 5% by weight of glass beads in distilled water

The final weight of each bag is 10g. You put the dialysis bags into three separate flasks of distilled water. After 2 hours, you remove the bags and record these weights:

Glucose Bag - 13.2g  
Albumin Bag - 10.1g  
Glass Bead Bag - 10.0g

How can you explain these results?

**Part 2: How is the structure of the cell membrane related to its function?**

Draw a diagram of the cell membrane in the space below. Include the phospholipid bilayer, as well as the different types of integral proteins. Include proteins for facilitated diffusion and active transport:

**Use the understanding that you have gained from your model to answer the questions on the next pages.**

1. Substances can move across the membrane via simple diffusion, facilitated diffusion or active transport

	a. Where does it occur in the membrane?	b. Does it require transport proteins?	c. Does it require an input of energy?
<b>Simple Diffusion</b>			
<b>Facilitated Diffusion</b>			
<b>Active Transport</b>			

d. What functions might each of the three types of diffusion serve in an independent cell like a *paramecium* or an amoeba?

e. What functions might each of the three types of diffusion serve in a multicellular organism--for example a human or a tree?

2. The ratios of saturated to unsaturated phospholipids in an organism's membranes can change in response to changes in environmental conditions.

a. How do the properties of a membrane that contains a low percentage of unsaturated phospholipids compare with those of a membrane that contains a high percentage of unsaturated phospholipids?

b. Considering what you know about the properties of saturated and unsaturated fatty acids, would you expect an amoeba that lives in a pond in a cold northern climate to have a higher or lower percentage of saturated fatty acids in its membranes during the summer as compared to the winter? Explain your answer.

3. A fish is removed from a contaminated lake. You determine that a particular toxin is present in its cells at a specific concentration ("level A"). You place the fish in a tank full of clean water and measure the toxin concentration in the cells several days later ("level B")

a. You hypothesize that the toxin is strictly fat-soluble--that is, not water-soluble. If this hypothesis is valid, what relationship would you expect to see when you compare the toxin levels in the fish before (level A) and after (level B) several days in the tank. Explain your reasoning.

b. After making your hypothesis, you test it by measuring the toxin levels in the fish at various times during its several days in the tank. You observe that the level of toxin drops in the fish from level A to level B and then stabilizes at level B. You test the water in the tank and find that after it stabilizes, the toxin is present in the tank water at concentration B also. Which transport process is most likely eliminating the toxin from the fish? Passive transport or active transport? Explain your reasoning.

c. Given the situation in part b? what should you do to reduce the toxin level in the fish below level B?